

*John File*MEMO:

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TO:

FROM:

DATE:

7th. NOVEMBER. 1960.

*Just**Active*IMAGE ENHANCEMENT VIEWER.

The viewer at present on loan to Itek, has now been modified according to the contract schedule. This means that we now have an instrument with adequate illumination and somewhat more simple to operate. However it is still inadequate in terms of image enhancement in that:

- a) It still operates in areas of maximum density differences, thus enhancing the edges of images already clearly apparent by other viewing methods.
- b) All micro or near micro densities are filtered out, and this includes all the imagery we want to enhance.

The attached Itek proposal is to define a way of overcoming these

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defects. [REDACTED] has, I know, conferred with the Frenchman, Marechal who was one of the first in the field of Spatial filtering. He has discussed his approach, and the consensus of opinion was, I understand, that Swing was most definitely on the right track. This referred to [REDACTED] proposal STATOTHR

to use partially occluding filter discs rather than fully occluding discs as are now incorporated in the instrument. I have discussed with [REDACTED] STATOTHR

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[REDACTED] to the best of my ability the theory, of such an approach, and this, plus the results of Itek supported research lead me to think that we may be only this one step from achieving the results which have so far eluded us. Others have at times discussed the possibilities of partial filtering whereby tonal

quality is preserved at the expense of complete filtering. The combined result however of tonal preservation and partial edge enhancement gives the desired result of an outlined image without filtering out the all important small density difference formations. I have seen some gross examples of this at Itek which support in practise, the theory behind the process.

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I personally do not believe [REDACTED] would formulate a proposal, as he has done here, without a good deal of merit. Nor do I think he would let himself in for any work without having previously proved to himself what he intends to prove to a contracting agency. I feel that the T.D.B. should carefully consider this proposal. Other agencies, notably R.A.D.C. and Army Signals have expressed more than passing interest in this method of enhancement, and it seems a pity to have developed it thus far with the viewer, and then leave it only partially finished.

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NB. The semi-opaque discs can in some ways be compared with phase-contrast microscopy. This is in fact a means of attenuating light rays so that light in phase reaches the optic plane. We know phase contrast has some merit.

Technical Proposal for Research and Development on

The Image Enhancement Viewer

Introduction:

The Image Enhancement Viewer has now been modified, according to the program set forth in Phase I of the previous Technical Proposal. The illumination of the object transparency is now more than adequate for the value of object densities normally used in the equipment. The new, automatic filter positioning feature reduces the time (and requisite skill) for changing filter positions.

It appears that the major usefulness of the Image Enhancement Viewer, at present, lies more in its mensurational capabilities than in image (or edge) enhancement. Research studies carried out at Itek over the past ten-month period have shown image enhancement to be a complex process when using the occluding filters presently installed in the Image Enhancement Viewer. In brief, image enhancement using occluding discs in the center of the diffraction pattern to produce a filtered image is not a simple, one-step process. This company-supported research will culminate in a report* which will show that to achieve image enhancement under such filtering conditions a two-step, carefully controlled photographic process is necessary. Such complexity is necessary in order to preserve image tonal values and reduce "ringing" effects which result from removing the center of the diffraction pattern.

It has been known, for some time, that image contrast may be improved by attenuating the lower spatial frequencies rather than removing them. In France, Marechal and Croce have investigated this effect and demonstrated its usefulness. Such an operation is exemplified by a disc of semi-opaque properties which does not distort phase and which gradually (and smoothly) fades into complete transparency.

From basic diffraction theory, together with the results of the report shown in the footnote, the qualitative aspects of frequency attenuating filters may be predicted in a general way. It is anticipated that such a means of filtration would provide the basis for a less complex, more useful means of image enhancement. It is conceivable that a one-step enhancement procedure can be evolved

* The report presently being prepared for publication is entitled, "Theoretical and Experimental Considerations of Spatial Filtering and Image Enhancement, Part I: Sharp Cutoff, Occluding Filters," by [REDACTED] Optical Physics Section, Itek Corporation.

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from such filtering methods. The quantitative aspects of frequency attenuation, particularly as they apply to incorporation in and improvement of the Image Enhancement Viewer are more difficult to hazard at this time.

Prior to continued use of the present instrument or proposed sophistication through increased magnification and mechanized mensuration methods, it is felt that an additional research study should be carried out. Such a program would investigate frequency attenuating filters and provide a more practical basis upon which to decide the ultimate fate of the instrument. Should such a method of filtering (and enhancement) prove feasible, and a practical means worked out for their construction, filters can be incorporated directly into the Image Enhancement Viewer.

Proposal:

In light of the aspects covered in the introductory discussion, a five-months research and development program is proposed. It is predicated on the availability and use of the Image Enhancement Viewer, presently assigned to Itek on a loan basis. The instrument would be returned to the contracting agency at the end of the research period unless subsequent negotiations decide otherwise. Should the instrument be recalled earlier than this, it is to be understood that the instrument will be made available for tests, from time to time, and additional funds provided to cover travel costs. The proposal can be categorically presented as:

- a) Investigate the feasibility of frequency attenuating filters and their application to image enhancement, determine the analytical means for their evaluation, and ascertain the limitations of image enhancement resulting from their use.
- b) Conduct an experimental program to devise a practical way for constructing and mounting frequency attenuating filters. Consider mechanical and photographic means of making such filters, and determine specifications on the glass or other supporting structure necessary to hold them accurately in place. All methods and tests are to be correlated with theoretical developments.
- c) As guided by a) and b) construct a set of such filters, if theory and tests indicate feasibility, which can be

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incorporated in the Image Enhancement Viewer. This filter set shall not exceed four in number. Perform filtering operations on photographic transparencies (which can be supplied by the contracting agency, if so desired) to demonstrate the quantitative aspects of the resultant enhancement.

- d) As a result of these research and development studies, issue a summary report which demonstrates the analytical and experimental methods used for the program. The report will include an evaluation of the enhancement produced by frequently attenuating filters and provide specific recommendations for future development of the instrument, if deemed advisable. The report would be issued no later than one month after the five-month research and development period.

Approved For Release 2000/05/10 : CIA-RDP78B04747A003100010019-7

September 18, 1960
Project 9005.18

| 9005.18 SPARE PARTS | | | | | | | | | | | |
|--|----------|----------|--------|-------------------------|---------------------|----------|--------------|-----------------|--------------|--------------|----------------------|
| C. P. F. F. PROPOSAL | | | | | | | | | | | |
| DESCRIPTION | ITEM NO. | QUANTITY | HOURS | DIRECT LABOR DOLLARS | OVERHEAD @ 150 % | MATERIAL | SUB TOTAL | G & A @ 12 % | SUB TOTAL | FEE @ 8 % | TOTAL C. P. F. F. |
| OSRAM HBO-200 Mercury Lamp (AC) | 1 | 2 | - | - | - | \$ 84.60 | \$ 84.60 | \$10.15 | \$ 94.75 | \$ 7.58 | \$102.33 |
| OSRAM HBO-107/1 Mercury Lamp (DC) | 2 | 2 | - | - | - | 99.00 | 99.00 | 11.88 | 110.88 | 8.87 | 119.75 |
| Heat Absorbing Glass, 2" x 2" Edmund Sc. Cat. #4010 | 3 | 6 | - | - | - | 1.20 | 1.20 | .14 | 1.34 | .11 | 1.45 |
| 5461 A Interference Filter 75 A Passband, 2" x 2" | 4 | 1 | - | - | - | 100.00 | 100.00 | 12.00 | 112.00 | 8.96 | 120.96 |
| Aerolite P82Z Capacitor Imfd, 600 Volt, tubular | 5 | 2 | - | - | - | 2.86 | 2.86 | .34 | 3.20 | .26 | 3.46 |
| ZTL1-7 Toggle Switch, 2 pole | 6 | 2 | - | - | - | 13.20 | 13.20 | 1.58 | 14.78 | 1.18 | 15.96 |
| BZ-RW922-A2 Roller Lever, Type Z, Microswitch | 7 | 2 | - | - | - | 18.10 | 18.10 | 2.17 | 20.27 | 1.62 | 21.89 |
| V3-1 Microswitch, JV-5 Actuator | 8 | 1 | - | - | - | 1.62 | 1.62 | .19 | 1.81 | .14 | 1.95 |
| Globe Planetary Gear Reduction #83A114-352.6 (60 cy) 110 vac. | 9 | 1 | - | - | - | 85.00 | 85.00 | 10.20 | 95.20 | 7.62 | 102.82 |
| 3 Voltage Actuated Relay #KRP14A 115 vac. | 10 | 6 | - | - | - | 45.00 | 45.00 | 5.40 | 50.40 | 4.03 | 54.43 |
| 3AB-12 Littlefuse, 12 Amps | 11 | 5 | - | - | - | .50 | .50 | .06 | .56 | .04 | .60 |
| NE-51 Neon Lamp | 12 | 4 | - | - | - | .68 | .68 | .08 | .76 | .06 | .82 |
| 11ex ACME Shutter, Size #4, 1-3/4" Iris Opening | 13 | 1 | - | - | - | 53.00 | 53.00 | 6.36 | 59.36 | 4.75 | 64.11 |
| #431-1 Folded Frame Solenoid 110v 6cy | 14 | 3 | - | - | - | 9.00 | 9.00 | 1.08 | 10.08 | .81 | 10.89 |
| #389-1 Folded Frame Solenoid | 15 | 4 | - | - | - | 13.00 | 13.00 | 1.56 | 14.56 | 1.16 | 15.72 |
| Quality Control Inspection Total | 16 | - | 8.00 | 24.00 | 36.00 | - | 60.00 | 7.20 | 67.20 | 5.38 | 72.58 |
| TOTAL C. P. F. F. | 17 | - | \$8.00 | \$24.00 | \$36.00 | \$526.76 | \$586.76 | \$70.39 | \$657.15 | \$52.57 | \$709.72 |